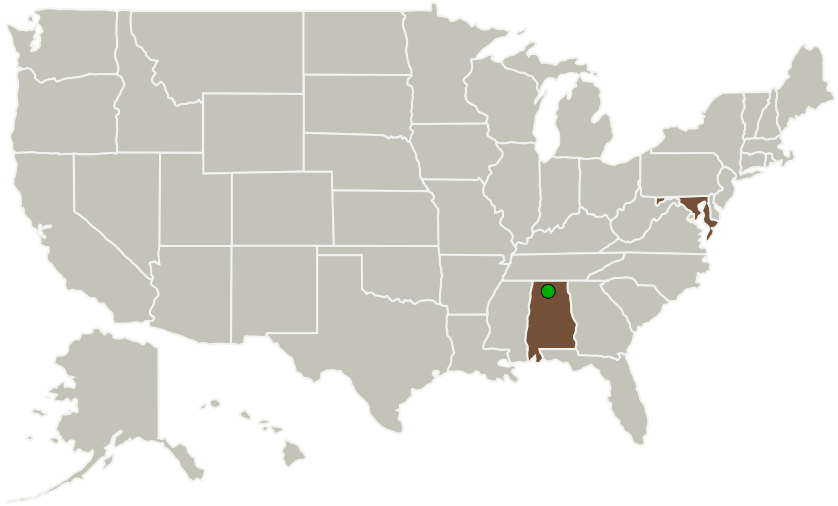
High Performance Consumer-Affordable Nanocomposite Mirrors with Supersmooth Surfaces, Precise Figuring, and Innovative 3D Printed Structures, Phase I

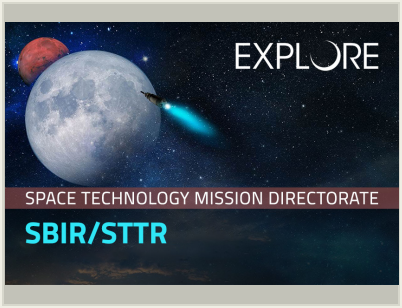
Completed Technology Project (2015 - 2015)

Project Introduction

Lightweight Telescopes, Inc. (LWT) proposes to advance the TRL, demonstrate performance, and initiate commercialization of nanocomposite optics technology (NCOT). This new technology is based on carbon nanotubes (CNT), assorted powders and fibers, polymers, and proprietary processes to craft precisely shaped and supersmooth UVOIR optical surfaces. The fabrication of optical quality mirrors based on CNTs embedded in an epoxy matrix (CNT/E) has already been demonstrated1 and is being patented by LWT. It is proposed that, with the infusion of advanced numerical modeling and state-of-the-art 3D printing techniques, NCOT can become an enabling technology for future space telescopes (and missions) by virtue of its many unprecedented capabilities. NCOT, unlike other space optics, is truly low cost in that the mirrors are affordable to consumers. Additional capabilities include rapid fabrication, supersmooth surfaces, multiple identical units, very large apertures, low density material, 'smart' optics, smart structures, athermal telescopes, and in situ fabrication of very large aperture (Deca- and Hexa-meter class) optics on the ground and in space. This proposal seeks to advance development of nanocomposite optics technology by augmenting LWT's proven techniques and processes with better tooling and test equipment, numerical design of novel structures that maximize stiffness/mass ratio, and 3D printing assisted fabrication. Specific objectives of this Phase I proposal are to design and fabricate state-of-the-art 25 cm mirrors, and to fabricate, field test, and commercialize 15 cm mirror telescopes.

Primary U.S. Work Locations and Key Partners





High Performance Consumer-Affordable Nanocomposite Mirrors with Supersmooth Surfaces, Precise Figuring, and Innovative 3D Printed Structures, Phase I

Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

High Performance Consumer-Affordable Nanocomposite Mirrors with Supersmooth Surfaces, Precise Figuring, and Innovative 3D Printed Structures, Phase I

Completed Technology Project (2015 - 2015)

Organizations Performing Work	Role	Type	Location
Lightweight Telescopes, Inc.	Lead Organization	Industry Minority-Owned Business	Columbia, Maryland
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Maryland

Project Transitions

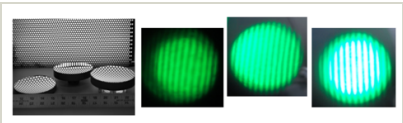
June 2015: Project Start

December 2015: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139055)*

Images



Briefing Chart
High Performance Consumer-Affordable Nanocomposite Mirrors with Supersmooth Surfaces, Precise Figuring, and Innovative 3D Printed Structures Briefing Chart *(https://techport.nasa.gov/image/129343)*

Final Summary Chart Image
High Performance Consumer-Affordable Nanocomposite Mirrors with Supersmooth Surfaces, Precise Figuring, and Innovative 3D Printed Structures, Phase I Project Image *(https://techport.nasa.gov/image/127473)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Lightweight Telescopes, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

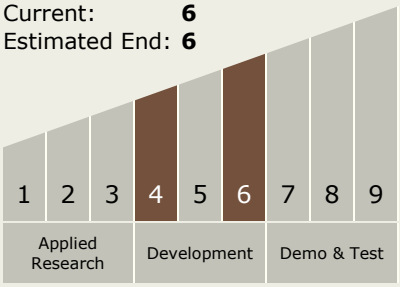
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Peter Chen

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



High Performance Consumer-Affordable Nanocomposite Mirrors with Supersmooth Surfaces, Precise Figuring, and Innovative 3D Printed Structures, Phase I

Completed Technology Project (2015 - 2015)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.3 Electronics and Optics Manufacturing Process

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System